ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ENGINEERING CONSULTANTS SECTION
205 South 17th Avenue - Room 293E, Mail Drop 616E
Phoenix, Arizona 85007

Arizona Governor's Award for Quality
1995 Pioneer Award Recipient

June 17, 1999

Engineering Consultants Section

INFORMATION BULLETIN 99-12

TO: Consultants

FROM: Engineering Consultants Section

SUBJECT: Roadway Design Technical Memos

The ADOT Roadway Design Section has prepared the following technical memos to be used for all ADOT Roadway Engineering design projects:

1. 2-Foot Offset Distance to Roadside Barriers
2. Runout Lengths for Barrier Design, Roadway Design Guidelines, 1996-Table 305.6
3. Revisions to Construction Standard Drawings: F-Shape Barrier; Type C Freeway Curb & Catch Basin
4. SKT 350 Guard Rail End Terminal

If there are any questions please contact the Roadway Design Section at (602) 712-7341.

ARIZONA DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING GROUP
OFFICE MEMO

May 11, 1999

TO: Roadway Design Personnel
ADOT and Consultants

FROM: Terry H. Otterness THO
Design Program Manager
Roadway Design Section

RE: **2-Foot Offset Distance to Roadside Barriers**

The attached summary has been prepared to clarify for designers the application of the desired 2-foot offset distance from normal shoulder to roadway barriers. This is in response to several inquiries that have come up in applying various reference materials and guidelines. The summary has been prepared in Draft form for immediate use but will also allow feedback from users prior to finalization. Please address any comments, questions, or items for discussion to Bob Trujillo or me.

Please distribute to your respective design and predesign personnel including the consultants working under your direction.

attach: 4 pages

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2 FT OFFSET DISTANCE TO BARRIER

Roadway Design Section has prepared this summary to clarify issues concerning the 2 ft offset distance to any type of barrier in response to various inquiries concerning various applications. The following is a compilation of references, guidelines, sources of information and standard practices relating to the 2 ft offset distance. The 2 ft offset distance is as measured from the normal shoulder width.

GUARD RAIL

C-10.01 / TYPE A GUARD RAIL INSTALLATION - Guard rail is installed at normal shoulder width.

C-10.02 / TYPE B GUARD RAIL INSTALLATION - Guard rail is installed with a 2 ft offset from the normal shoulder width. The extra 2 feet of pavement is gained by widening from the normal roadway shoulder. The location of subgrade or slope hinge point is not affected by the 2 foot pavement widening.

Standard Practice:

Type B guard rail with a 2 ft offset shall be used in all new roadway construction projects, major reconstruction and most pavement widening projects.

Type A guard rail may be used on roadway widening projects when the new guard rail is consistent with existing guard rail in the vicinity.

A replace-in-kind (Type A or B) process is used on pavement preservation projects when the existing guard rail components are being upgraded. Since the typical on standards C-10.01 and C-10.02 is for new construction only, a detail must be provided to cover the guard rail installation on pavement preservation projects. An exception to the replace-in-kind process on pavement preservation projects is the replacement of existing Type A guard rail with Type B guard rail in locations where the extra offset is desired and the existing embankment shoulder has adequate width to preclude new slope construction.

2 FT OFFSET DISTANCE TO BARRIER

CONCRETE MEDIAN BARRIER AND CONCRETE HALF BARRIER

Standard Practice:

RURAL HIGHWAYS:

Controlled-Access

Mainline	Two foot offset distance to the barrier shall be provided.
Ramps	Two foot offset distance to the barrier shall be provided.
Freeway to Freeway Ramps (No Structure)	Two foot offset distance to the barrier shall be provided as noted below.
One Lane Ramp (No Structure) Mimimum Width With and Without Barrier	6 ft 12 ft 10 ft = 28 ft* | Shld | Travel Lane | Shld |
Two Lane Ramp (No Structure) Minimum Width With Barrier	2 ft 4 ft 12 ft 12 ft 8 ft 2 ft = 40 ft | Offset | Shld | Travel Lane | Travel Lane | Shld | Offset |
Freeway to Freeway Ramps (With Structure)	Two foot offset distance to the barrier is provided with the shoulder widths noted below.
One Lane Ramp (No Structure) Mimimum Width With and Without Barrier	6 ft 12 ft 10 ft = 28 ft* | Shld | Travel Lane | Shld |
Two Lane Ramp (With Structure) *Minimum Width With and Without Barrier	4 ft 12 ft 12 ft 8 ft = 36 ft* | Shld | Travel Lane | Travel Lane | Shld |

* Do not add any additional width to these ramps. The two foot offset for the barrier is included in the shoulder width.

Non-Controlled-Access

Rural and Fringe-Urban Roadways	Two foot offset distance to the barrier shall be provided.
Frontage Roads	Two foot offset distance to the barrier shall be provided.

2 FT OFFSET DISTANCE TO BARRIER

URBAN HIGHWAYS:

Controlled-Access

Mainline Outside Shoulder	Two foot offset distance to the barrier shall be provided.
Mainline Median Shoulder	Two foot offset distance to the barrier is normally not provided in Ultimate condition. The standard 70 foot median between mainline roadway does not provide sufficient distance to have the 2 ft offset distance to the barrier. Provide 2 ft offset distance to barrier during Interim stage, if applicable.
Ramps	Two foot offset distance to the barrier shall be provided throughout high speed area of the ramp. The inside barrier on the ramps of a single point urban interchange shall have the 2 ft offset distance.
Freeway to Freeway Ramps (No Structure)	Two foot offset distance to the barrier shall be provided as noted below.
One Lane Ramp (No Structure) Mimimum Width With and Without Barrier	6 ft 12 ft 10 ft = 28 ft* | Shld | Travel Lane | Shld |
Two Lane Ramp (No Structure) Minimum Width With Barrier	2 ft 4 ft 12 ft 12 ft 8 ft 2 ft = 40 ft | Offset | Shld | Travel Lane | Travel Lane | Shld | Offset |
Freeway to Freeway Ramps (With Structure)	Two foot offset distance to the barrier is provided with the shoulder widths noted below.
One Lane Ramp (No Structure) Mimimum Width With and Without Barrier	6 ft 12 ft 10 ft = 28 ft* | Shld | Travel Lane | Shld |
Two Lane Ramp (With Structure) *Minimum Width With and Without Barrier	4 ft 12 ft 12 ft 8 ft = 36 ft* | Shld | Travel Lane | Travel Lane | Shld |

* Do not add any additional width to these ramps. The two foot offset for the barrier is included in the shoulder width.

Non-Controlled-Access

Frontage Roads (2-14 ft Lanes With Type D Curb & Gutter)	Two foot offset distance to the barrier is desirable.

Most urban highways have curb and gutter. Additionally, concrete half barrier is normally used in lieu of guard rail, therefore, the 2 ft offset distance is normally provided by extending the 2.5 foot gutter width to 4.5 as shown in Std drawings C-10.62 and C-05.10.

2 FT OFFSET DISTANCE TO BARRIER

References:

Roadway Design Guidelines - Section 305.2 - In the interest of overall economy and maintainability, guardrail should be installed parallel to the edge of pavement (i.e., not flared) and offset 2 feet from the outside nominal edge of the shoulder. (See Construction Standard Drawings for Type B guardrail installation.)

Roadway Design Guidelines - Page 300-19, Section 305.4, fourth paragraph, second sentence - This barrier is most effective when placed parallel to the roadway and offset from the shoulder by 2 foot.

1990 AASHTO Green Book (English) - Chapter IV, Shoulders, page 335 - The "usable" width of shoulder is the actual width that can be used when a driver makes an emergency or parking stop. See Figure IV-2D on page 336.

1990 AASHTO Green Book (English) - Chapter IV, Width of Shoulders, page 338, second paragraph - Where roadside barriers, walls, or other vertical elements are used, the graded shoulder should be wide enough that these vertical element can be offset a minimum of 2 ft from the outer edge of the usable shoulder as shown in Figure IV-2D.

1990 AASHTO Green Book (English) & 1994 AASHTO Green Book (Metric) - Chapter X, Lateral Clearances, page 879, first paragraph - On overpass structures it is desirable to carry the full width of the approach roadway across all structures.

1990 AASHTO Green Book (English) & 1994 AASHTO Green Book (Metric) - Chapter X, Lateral Clearances, page 879, second paragraph - When the full approach roadway width is continued across the structure, the parapet rail, both left and right, should aline with the guardrail on the approach roadway. For example, where the standard practice of the highway agency is to place the longitudinal barrier 2 ft from the outer edge of the surfaced shoulder, the bridge rail usually is placed 2 ft outside the effective edge of the shoulder. This width increment provides additional clearance for high-speed operation and door-opening space for vehicles stopped on the shoulder of the structure.

ARIZONA DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING GROUP
OFFICE MEMO

May 13, 1999

TO: Roadway Design Personnel
ADOT and Consultants

FROM: Terry H. Otterness THO
Design Program Manager
Roadway Design Section

RE: **Runout Lengths for Barrier Design**
Roadway Design Guidelines, 1996- Table 305.6

The following Table for barrier runout lengths has been adopted from the AASHTO Roadside Design Guide. Use of this table will allow lesser runout lengths for design ADTs less than 6000. Please substitute the following table for Table 305.6 in the Roadway Design Guidelines. The new table will be included in a future English update.

Table 305.6
Roadside Barrier Runout Length

	Traffic Volume (ADT)			
	Over 6000	2000-6000	800-2000	Under 800
Design Speed (mph)	Runout Length L_R(ft)	Runout Length L_R(ft)	Runout Length L_R(ft)	Runout Length L_R(ft)
70	480	440	400	360
60	400	360	330	300
50	320	290	260	240
40	240	220	200	180
30	170	160	140	130

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ARIZONA DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING GROUP
OFFICE MEMO

May 13, 1999

TO: Roadway Design Personnel
ADOT and Consultants

FROM: Terry H. Otterness THO
Design Program Manager
Roadway Design Section

RE: **Revisions to Construction Standard Drawings:**
F-Shape Barrier ; Type C Freeway Curb & Catch Basin

ADOT has adopted a revision to the configuration of concrete barrier from the New Jersey shape to the F-Shape. Although the New Jersey shape is still acceptable, the F-Shape has been crash tested and exhibits superior performance characteristics. The applicable C-Stds. have been revised to reflect the F-Shape and will be issued in a supplemental package targeted for July. In the interim period, the drawings are available to be inserted into the plans as Roadway Group Plans Details. The drawings are available from Jeri Pulkinen at 602-712-7355 and are to be used to substitute for the following C-Stds: C-10.31: C-10.62; C-10.70; C-10.71; C-10.75.

Details have also been developed and are available for F-Shape 42" concrete half-barrier and half-barrier vertical transitions from 42" to 32". These will become new Standard Drawings.

Std. C-05.10 Type C (Freeway) Curb and Gutter has been modified to decrease the 2" depression. With the new 0.625" drop, the gutter slope will closely match the cross-slope of the adjacent pavement. The decrease in the depression increases the ponding elevation available to top of curb, increases the available spread ,which then allows greater economy in catch basin spacing. Std. C-15.91, Freeway Catch Basin Details, has been modified to reflect the required frame and grate dimensions for the new Type C Curb and Gutter. The interim drawings for Std. C-05.10 and C 05.91 are also available from Jeri.

Please distribute copies of this memo to design personnel including consultants working in your respective areas.

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ARIZONA DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING GROUP
OFFICE MEMO

June 4, 1999

TO: Roadway Design Personnel
ADOT and Consultants

FROM: Terry H. Otterness THO
Design Program Manager
Roadway Design Section

RE: **SKT 350 Guard Rail End Terminal**

The SKT 350 (Sequential Kinking Terminal) is a tangent type guard rail end terminal meeting NCHRP Report 350 Test Level 3 crash criteria. The SKT 350 terminal has been reviewed and approved for use by the ADOT Traffic Product and Maintenance Product Evaluation Committees. The SKT 350 will replace the BEST 350 (discontinued) as a plans alternate for tangent type terminals. The SKT 350 is a 50' long tangent type system consisting of an impact head which sequentially kinks the w-beam guardrail, a cable anchor and bracket assembly, ground strut, wood posts and blocks, and steel foundation tubes.

The Barrier Summary Sheet has been revised to show the SKT 350 in lieu of the BEST 350.

Specifications covering the SKT 350 have been developed and are available upon request from Contracts and Specifications Services.

Details have been developed for the Layout for the SKT 350 for placement along normal shoulder and also with curb and gutter. The details have been prepared as Roadway Group Plans Details and should be included in the plans as applicable. In-house personnel can obtain electronic files of the details in the Cadd Detail Cell library and consultants may obtain the Details through the Roadway Design Cadd Support Team at 602-712-7341. We are in the process of creating a ADOT Roadway Design Web page for consultant access.

The SKT 350 is manufactured by Road Systems, Inc. of Big Spring, Texas and is available through Universal Industrial Sales of Linden, Utah. John Durkos of Road Systems may be reached at 815-464-5917.

The Manufacturer's Approved drawings and Installation Instruction Booklets have been sent to the Districts. Additional copies for designers may be obtained by contacting Tom Scheck at 602-712-8674.

Please implement this alternate on all current design projects where the BEST 350 is or was previously an option.

Please distribute this memo to design personnel, project managers and other affected personnel within your respective groups.

Please call Tom Scheck, Jeri Pulkinen, or me at 602-712-7341 for any questions regarding the SKT 350 materials.

c.
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